USB1010
User's Manual

Beijing ART Technology Development Co., Ltd.

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Chapter 1 Overview

1.1 Introduction

USB1010 is a 2-axis motion control card which can control 2 axes of either stepper motor or pulse type servo drivers for position, speed, and interpolation controls.

1.2 Features

- ✧ USB interface
- ✧ 2-axis servo/stepper motor control, each axis can work independently.
- ✧ Pulse Output Frequency Error: <0.1%
- ✧ Maximum Pulse Output Speed: up to 4 MHz
- ✧ Pulse Output Mode: CP/DIR, CW/CCW
- ✧ Non-symmetrical linear acceleration/deceleration drive, S-shaped acceleration/deceleration
- ✧ Constant Speed Driving
- ✧ 2-axis linear interpolation, circular interpolation, bit pattern interpolation, and continuous interpolation.
- ✧ Start/stop multi-axis simultaneously
- ✧ Control acceleration/deceleration time through programmable
- ✧ Read logic position, physic position, drive speed, acceleration, and acceleration/deceleration status in real-time
- ✧ Isolation Voltage: 2500Vrms

1.3 Specifications

- ✧ Control Axis: 2 axes
- ✧ Data Bus: 16 bits

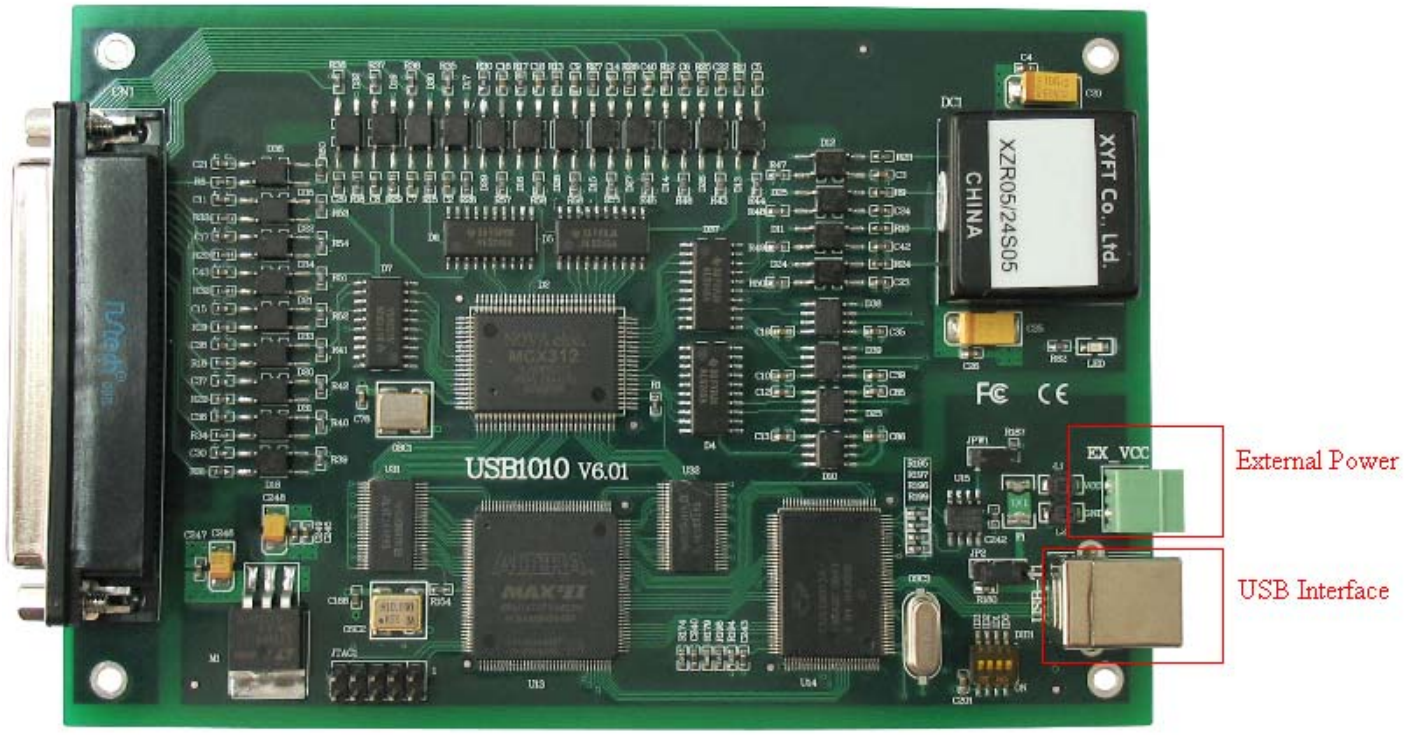
Interpolation Functions

- ✧ 2-axes Linear Interpolation
  - Interpolation Range — Each axis −8,388,607 ~ +8,388,607
  - Interpolation Speed — 1~4 MPPS
  - Interpolation Accuracy — ±0.5 LSB (Within the range of whole interpolation)
- ✧ Circular Interpolation
  - Interpolation Range — Each axis −8,388,607 ~ +8,388,607
  - Interpolation Speed — 1~4 MPPS
  - Interpolation Accuracy — ±1 LSB (Within the range of whole interpolation)
- ✧ 2 axes Bit Pattern Interpolation
  - Interpolation Speed — 1~4 MPPS (Dependent on CPU data writing time)
- ✧ Related Functions of Interpolation
  - Constant vector speed
  - Continuous interpolation
  - Single step interpolation

Common Specifications of Each Axis

- Drive Pulses Output (When CLK = 16 MHz)
  - Pulse Output Speed Range: 1 ~ 4MPPS
  - Pulse Output Accuracy within: ± 0.1% (according to the setting speed)
  - S-curve Jerk: 954 ~ 62.5x10^6 PPS/S2 (Multiple = 1)
  - Accelerating/Decelerating Speed: 125 ~ 1 x 10^6 PPS/S (Multiple = 1)
  - Initial Speed: 1 ~ 8,000PPS (Multiple = 1)
500PPS ~ 4×10^6 PPS (Multiple = 500)
  - Drive Speed: 1 ~ 8,000PPS (Multiple = 1)
500PPS ~ 4×10^6 PPS (Multiple = 500)
  - Output-pulse Number: 0 ~ 268,435,455 (fixed drive)
  - Speed Curve: Constant speed, linear acceleration, parabola S-curve acceleration/ deceleration drive
  - Fixed Drive Deceleration Mode: auto (non-symmetrical trapezoidal acceleration is also allowed)/manual
  - Output-pulse numbers and drive speeds changeable during the driving
  - Independent 2-pulse system or 1-pulse 1-direction system selectable
- Encoder Input
  - A/B quadrature pulse style or Up/Down pulse style selectable
- Position Counter
  - Logic Position Counter (for output pulse) range: −2,147,483,648 ~ +2,147,483,647
  - Real Position Counter (for feedback pulse) range: −2,147,483,648 ~ +2,147,483,647
Data read and write possible
- Comparison Register
  - COMP + Register Position comparison range: −2,147,483,648 ~ +2,147,483,647
  - COMP − Register Position comparison range: −2,147,483,648 ~ +2,147,483,647
  - Status and signal outputs for the comparisons of position counters
  - Software limit functioned
- External Signal for Driving
  - EXPP and EXPM signals for fixed pulse / continuous drive
- External Deceleration/Sudden Stop Signal
  - STOP0 ~ 2 3 points for each axis
Enable/disable and logical levels selectable
- Servo Motor Input Signal
  - ALARM (Alarm), INPOS (In Position Check)
Enable/disable and logical levels selectable
- General Input/Output Signal
  - IN0~1 two for each axis
  - OUT0~1 two for each axis
- Limit Signals Input
  - 1 point, for each + and − side
- Emergency Stop Signal Input
  - EMG, 1 point in all axes
Sudden stop the drive pulse of all axes when on Low level
- Electrical Characters
  - Operation Temperature: 0 ~ +50℃
  - Power Supply: 24V (External)
  - Input Clock Pulse: 16,000 MHz (Standard)

Chapter2 Component Layout

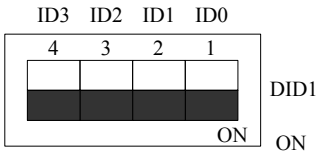


2.1 Input/Output Connector

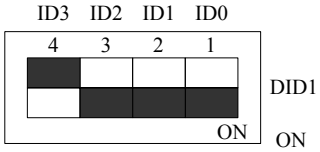
CN1: signal input/output connector

2.2 Physical ID of DIP Switch

DID1: Set physical ID number. When the PC is installed more than one USB1010 , you can use the DIP switch to set a physical ID number for each board, which makes it very convenient for users to distinguish and visit each board in the progress of the hardware configuration and software programming. The following four-place numbers are expressed by the binary system: When DIP switch points to "ON", that means "1", and when it points to the other side, that means "0." As they are shown in the following diagrams: place "ID3" is the high bit."ID0" is the low bit, and the black part in the diagram represents the location of the switch. (Test software of the company often uses the logic ID management equipments and at this moment the physical ID DIP switch is invalid. If you want to use more than one kind of the equipments in one and the same system at the same time, please use the physical ID as much as possible.)



The above chart shows"1111", so it means that the physical ID is 15.



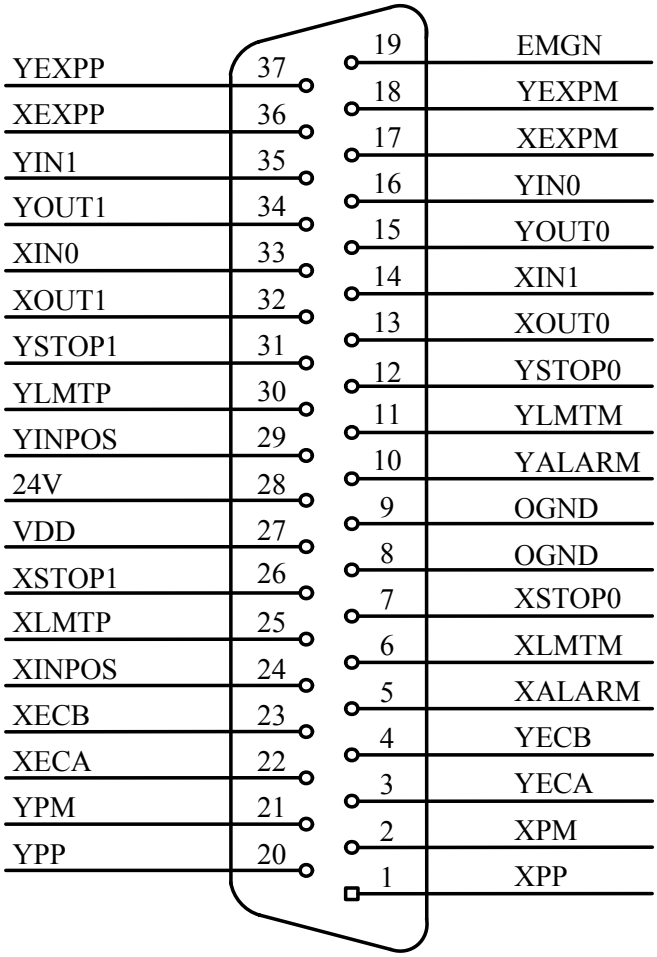
The above chart shows"0111", so it means that the physical ID is 7.

The above chart shows"0101", so it means that the physical ID is 5.

ID3	ID2	ID1	ID0	Physical ID（Hex）	Physical ID（Dec）
OFF（0）	OFF（0）	OFF（0）	OFF（0）	0	0
OFF（0）	OFF（0）	OFF（0）	ON（1）	1	1
OFF（0）	OFF（0）	ON（1）	OFF（0）	2	2
OFF（0）	OFF（0）	ON（1）	ON（1）	3	3
OFF（0）	ON（1）	OFF（0）	OFF（0）	4	4
OFF（0）	ON（1）	OFF（0）	ON（1）	5	5
OFF（0）	ON（1）	ON（1）	OFF（0）	6	6
OFF（0）	ON（1）	ON（1）	ON（1）	7	7
ON（1）	OFF（0）	OFF（0）	OFF（0）	8	8
ON（1）	OFF（0）	OFF（0）	ON（1）	9	9
ON（1）	OFF（0）	ON（1）	OFF（0）	A	10
ON（1）	OFF（0）	ON（1）	ON（1）	B	11
ON（1）	ON（1）	OFF（0）	OFF（0）	C	12
ON（1）	ON（1）	OFF（0）	ON（1）	D	13
ON（1）	ON（1）	ON（1）	OFF（0）	E	14
ON（1）	ON（1）	ON（1）	ON（1）	F	15

Chapter 3 Pin Layout

Pin Definition of CN1



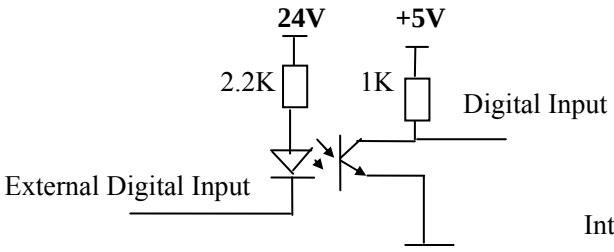
3.1 Analog Signal Pins

Pin No	Signal Name	Description
1 20	XPP YPP	Pulse +/Pulse: + direction dive pulse outputting
2 21	XPM YPM	Pulse −/Pulse: − direction dive pulse outputting
22 3	XECA YECA	Encoder−A/Pulse +in: signal for encoder phase-A input
23 4	XECB YECB	Encoder-B/Pulse -in: signal for encoder phase-B input
24 29	XINPOS YINPOS	In-position: input signal for servo driver in-position Enable/disable and logical levels can be set as commands. When “enable” is set, and after the driving is finished, this signal is active and standby.

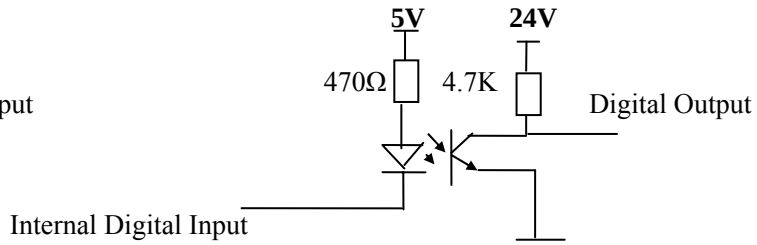
5 10	XALARM YALARM	Servo Alarm: input signal for servo driver alarm Enable/disable and logical levels can be set as commands.
25 30	XLMTP YLMTP	OVER Limit +: signal of + direction over limit During the + direction drive pulse outputting, decelerating stop or sudden stop will be performed once this signal is active.
6 11	XLMTM YLMTM	OVER Limit −: signal of − direction over limit During the − direction drive pulse outputting, decelerating stop or sudden stop will be performed once this signal is active.
7 12	XSTOP0 YSTOP0	input signal to perform decelerating/sudden stop for each axis
26 31	XSTOP1 YSTOP1	input signal to perform decelerating/sudden stop for each axis
14 35	XIN1 YIN1	General Input 1/: general purpose input signals
33 16	XIN0 YIN0	General Input 0/: general purpose input signals.
32 34	XOUT1 YOUT1	General Output 1/: general purpose output signals.
13 15	XOUT0 YOUT0	General Output 0/: general purpose output signals.
36 37	XEXPP YEXPP	External Operation +: + direction drive starting signal from external source When the fixed driving is commanded from an external source, +direction driving will start if this signal is down. Otherwise, when the continuous driving is commanded from an external source, + driving will start if this signal is on the Low level.
17 18	XEXPM YEXPM	External Operation −: − direction drive starting signal from external source When the fixed driving is commanded from an external source, − direction driving will start if this signal is down. Otherwise, when the continuous driving is commanded from an external source, − driving will start if this signal is on the Low level.
19	EMGN	Emergency Stop: input signal to perform the emergency stop for all axes When this signal in on the low level, including the interpolation driving, every axis will stop the operation immediately. The low level pulse width should be more than 2CLK. 【Note】For this signal, its logical levels cannot be selected.
27	VDD	+ 5V Power Terminal
28	24V	+ 24V Power Terminal
9, 8	OGND	Ground (0V) Terminal

3.2 General-purpose Signal Wiring

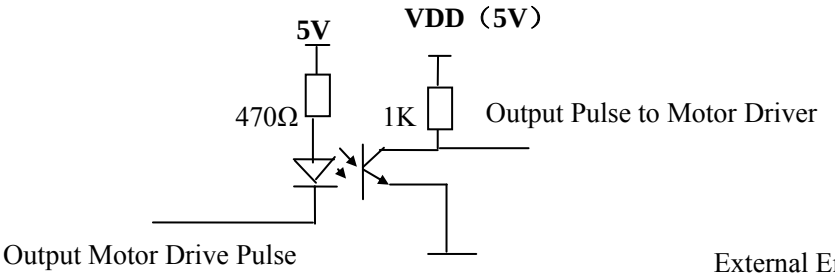
In USB1010, there are 2 general purpose input pins, nIN1~0 and 2 general output pins, nOUT1~0, for each axis.



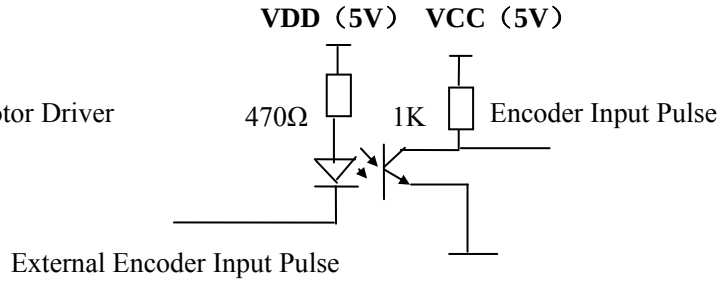
Contact-type Digital input



USB1010Digital Output



Motor Control Output Wiring Specifications



Encoder Input Pulse

Chapter 4 Brief Introduction

◆ 2-axis drive independently

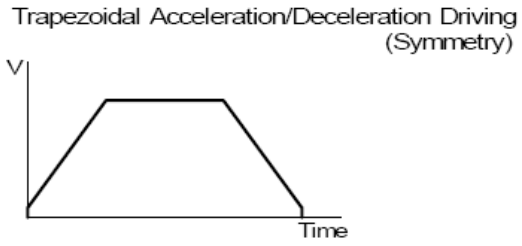
USB1010 can control four motors movement. Each axis can do fixed speed drive, linear acceleration/deceleration driving, and S-shaped acceleration/deceleration drive. 2-axis performance is the same.

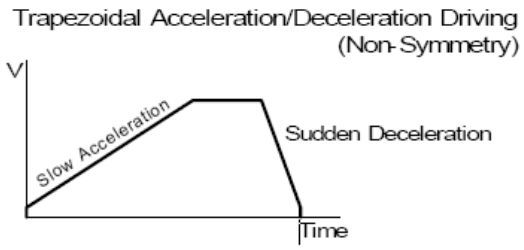
◆ Speed Control

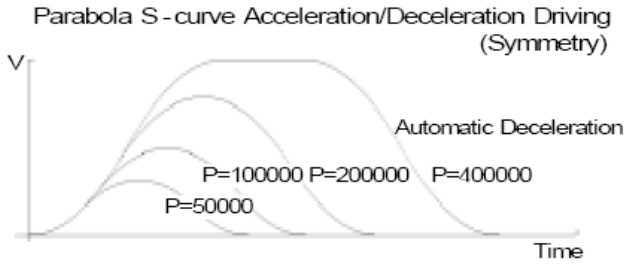
The speed range of the pulse output is from 1PPS to 4MPPS for constant speed, trapezoidal or S-curve acceleration/deceleration driving. Speed accuracy of the pulse output is less than ± 0.1% (at CLK=16MHz). The speed of driving pulse output can be freely changed during the driving.

◆ Acceleration/deceleration driving

The USB1010 can control each axis for acceleration/deceleration of constant speed driving, trapezoidal acceleration/deceleration driving (symmetry/non-symmetry), and S-curve acceleration/deceleration. Automatic acceleration/deceleration of linear acceleration fixed speed pulse driving is available and no need to set deceleration starting point by manual. Since a primary linear increase/decrease method is applied for S-curve acceleration/deceleration, the speed curve forms a secondary parabola acceleration/deceleration curve. In S-curve acceleration and deceleration fixed driving, automatic deceleration is available for symmetrical S-curve only and triangle waveforms during S-curve acceleration/deceleration are prevented by a special method.

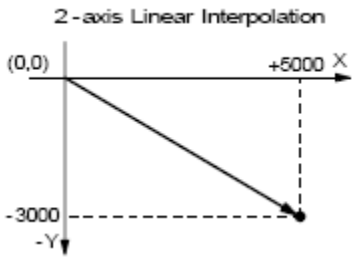






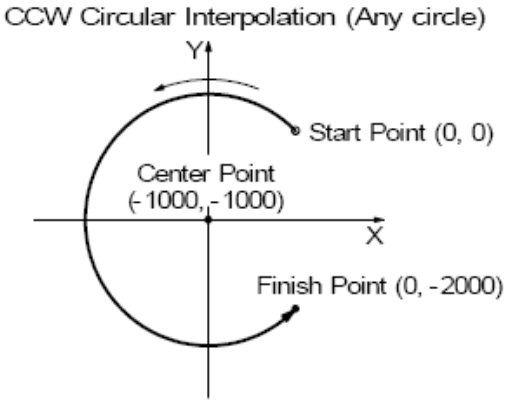
◆ Linear Interpolation

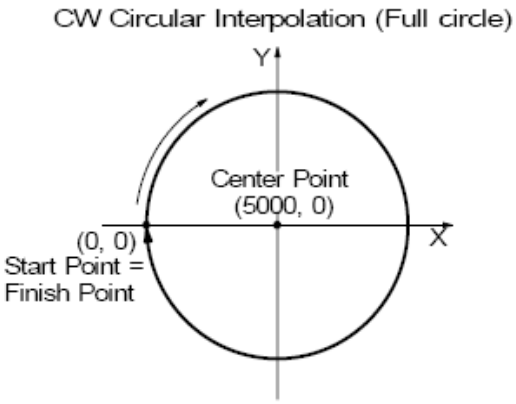
2 -axis linear interpolation can be performed. The position boundary is between coordinates −8, 388,607 and +8,388,607, and the positioning error is within ± 0.5 LSB (Least Significant Bit). The interpolation speed range is from 1 PPS to 4 MPPS.



◆ Circular Interpolation

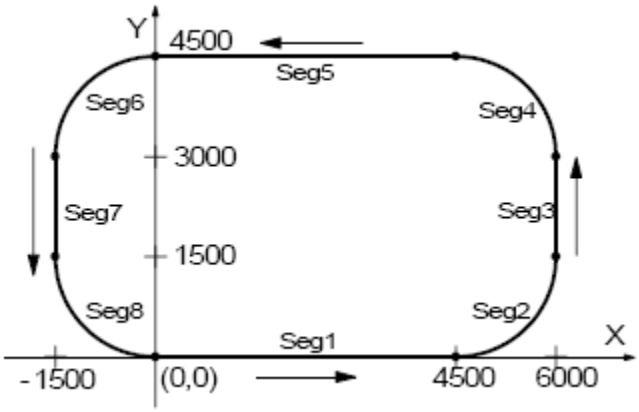
Circular interpolation can be performed. The position boundary is between coordinates −8, 388,608 and +8,388,607, and the positioning error is within ± 1 LSB. The interpolation speed range is from 1 PPS to 4 MPPS.





◆ The Bit Pattern Interpolation

This interpolation driving receives, for each axis in pulses, interpolation data that was converted to packet (a block of a predetermined amount of data) through the operation by the upper-level CPU and outputs interpolation pulses consecutively at the specified drive speed. This function enables drawing of various loci created by the upper-level CPU.



◆ Continuous Interpolation

Different interpolation methods can be used continuously, linear interpolation → circular interpolation → linear interpolation …. The maximum drive speed of performing continuous interpolation is 2 MHz.

◆ Constant Vector Speed Control

This function performs a constant vector speed. During the interpolation driving, USB1010 can set a 1.414 times pulse cycle for 2-axis simultaneous pulse output.

◆ Position Control

Each axis has a 32-bit logic position counter and a 32-bits real position counter. The logic position counter counts the number of output pulse, and the real position counter counts the feedback number of pulse from the external encoder or linear scale.

◆ Compare Register and Software Limit

Each axis has two 32-bit compare registers for logical position counter and real position counter. The comparison result can be read from the status registers. The comparison result can be notified by an interrupt signal. These registers can be also functioned as software limits.

◆ Driving By External Pulses

It is possible to control each axis by external signals. The +/− direction fixed driving, continuous driving or in manual pulsar mode can be also performed through the external signals. This function is used for JOG or teaching modes, and will share the CPU load.

◆ Servo Motor Feedback Signals

Each axis includes input pins for servo feedback signals such as in positioning.

◆ Real Time Monitoring

During the driving, the present status such as logical position, real position, drive speed, acceleration/deceleration, status of accelerating/decelerating and constant driving can be read.

Chapter 5 The Description of Functions

5.1 Pulse Output Command

There are two kinds of pulse output commands: fixed driving output and continuous driving output.

5.1.1 Fixed Driving Output

When host CPU writes a pulse numbers into USB1010for fixed driving and configures the performance such as acceleration / deceleration and speed, USB1010 will generate the pulses and output them automatically. Fixed driving operation is performed at acceleration/deceleration, as shown in Fig. 5.1, automatic deceleration starts when the number of pulses becomes less than the number of pulses that were utilized at acceleration and driving terminates at completion of the output of the specified output pulses.

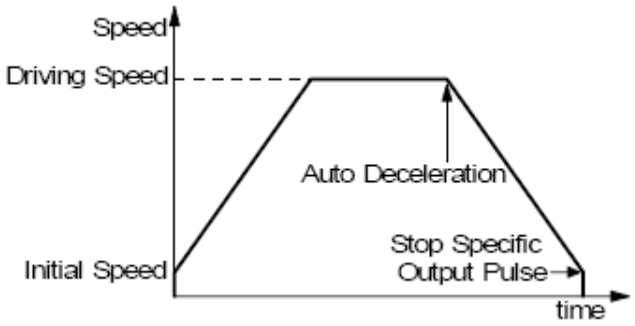


Fig. 5.1 Fixed Driving

◆ Changing the Number of Output Pulse in Driving

The number of output pulse can be changed in the fixed driving. If the command is for increasing the output pulse, the pulse output profile is shown as Fig. 5.2 or 5.3. If the command is for decreasing the output pulses, the output pulse will be stopped immediately as shown in Fig. 5.4. Furthermore, when in the S-curve acceleration/deceleration driving mode, the output pulse number change will occur to an incomplete deceleration S-curve.

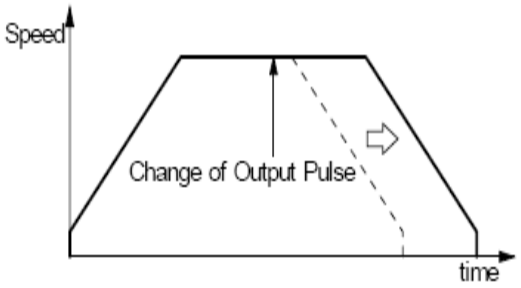


Fig. 5.2 Change of Output Pulse Number in Driving

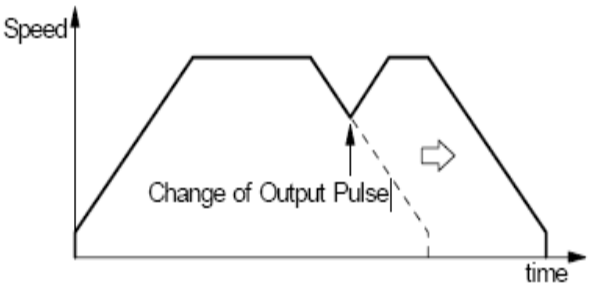


Fig. 5.3 Change the Number of Output Pulse during Deceleration

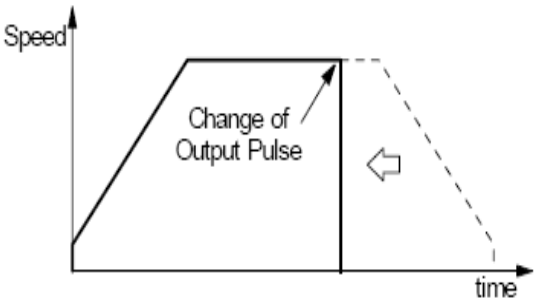


Fig. 5.4 Change the Pulse Number Less Than Output Pulse Number

◆ Manual Setting Deceleration for fixed Acceleration/Deceleration Driving

As shown in Fig. 5.1, generally the deceleration of fixed acceleration/deceleration driving is controlled automatically by USB1010. However, in the following situations, it should be preset the deceleration point by the users.

• The change of speed is too often in the trapezoidal fixed acceleration/deceleration driving.
• When use circular interpolation, bit pattern interpolation and continuous interpolation for acceleration and deceleration.

5.1.2 Continuous Driving Output

When the continuous driving is performed, USB1010 will drive pulse output in a specific speed until stop command or external stop signal is happened. The main application of continuous pulse driving is: home searching, teaching or speed control. The drive speed can be changed freely during continuous driving.

Two stop commands are for stopping the continuous driving. One is “decelerating stop”, and the other is “sudden stop”. Three input pins, STOP1~STOP0, of each axis can be connected for external decelerating and sudden stop signals. Enable/disable, active levels and mode setting are possible.

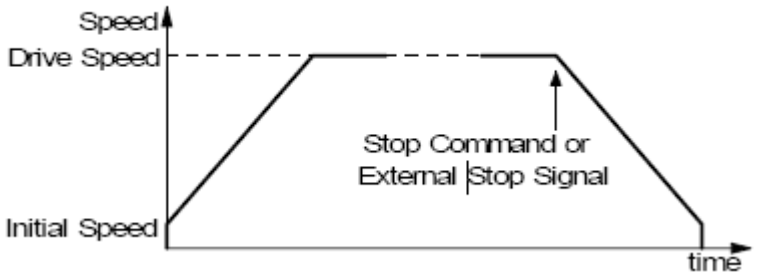


Fig. 5.5 Continuous Driving

5.2 Acceleration and Deceleration

Basically, driving pulses of each axis are output by a fixed driving command or a continuous driving command of the + direction or – direction. These types of driving can be performed with a speed curve of constant speed, linear acceleration, non-symmetrical linear acceleration, S-curve acceleration/deceleration according to the mode that is set or the operation parameter value.

5.2.1 Constant Speed Driving

When the drive speed set in USB1010 is lower than the initial, the acceleration/deceleration will not be performed, instead, a constant speed driving starts.

If the user wants to perform the sudden stop when the home sensor or encoder Z-phase signal is active, it is better not to perform the acceleration/deceleration driving, but the low-speed constant driving from the beginning.
For processing constant speed driving, the following parameters will be preset accordingly.

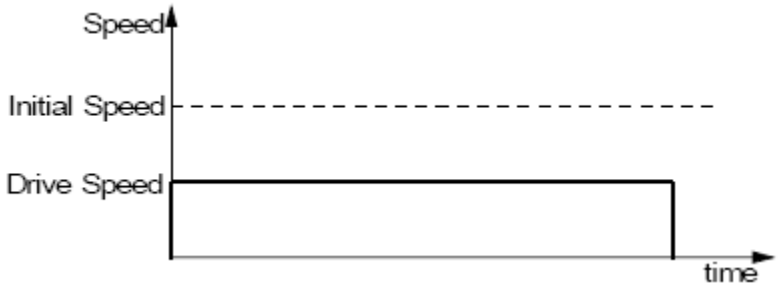


Fig. 5.6 Constant Speed Driving

5.2.2 S-curve Acceleration/Deceleration Driving

This card creates an S curve by increasing/reducing acceleration/decelerations in a primary line at acceleration and deceleration of drive speed. Figure 5.7 shows the operation of S-curve acceleration/deceleration. When driving starts, the acceleration increases on a straight line at the specified jerk (K). In this case, the speed data forms a secondary parabolic curve (section a). When acceleration reaches designation value (A), acceleration is maintained. In this case, the speed data forms an increase on a straight line (section b).

If the difference between the specified drive speed (V) and the current speed becomes less than the speed that was utilized at the increase of acceleration, the acceleration starts to decrease towards 0. The decrease ratio is the same as the increase ratio and the acceleration decreases in a linear form of the specified jerk (K). In this case, the speed data forms a secondary parabolic curve (section c). Thus, the case that acceleration has a constant part in its acceleration, this book calls it The Partial S curve Acceleration. On the other hand, if the difference between the specified drive speed (V) and the current speed becomes less than the speed that was utilized at the increase of acceleration before acceleration reaches designation value (A), section shifts from a to c without b section. Thus, the case that acceleration does not have a constant part in its acceleration, it calls The Perfect S curve Acceleration.

Please refer to example of parameter settings described later and appendix regarding cases of the partial S curve acceleration and the perfect S curve acceleration. Also at the deceleration, the speed forms an S curve by increasing/decreasing the deceleration in a primary linear form (sections d, e and f). The same operation is performed in acceleration/deceleration where the drive speed is changed during continuous driving.

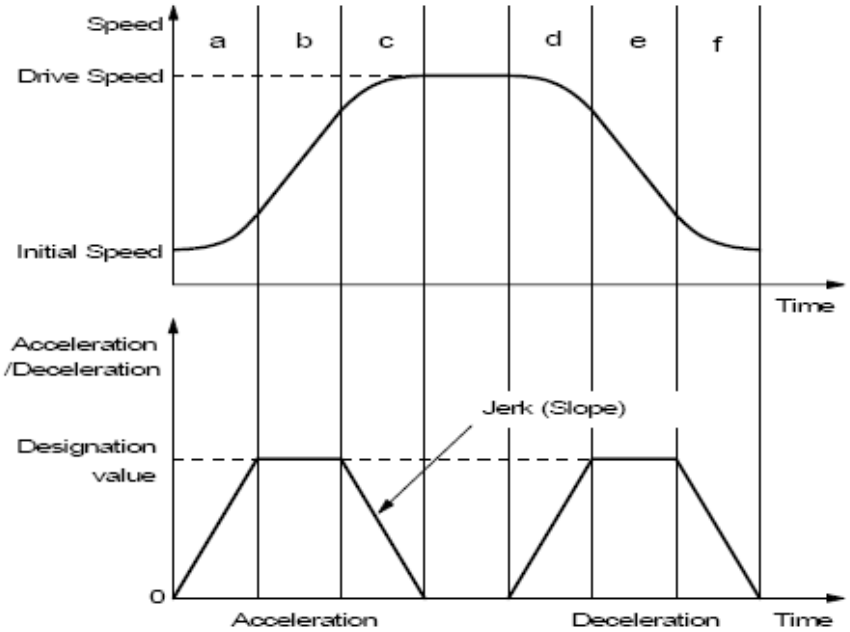


Fig. 5.7 S-Curve Acceleration/Deceleration Driving

5.3 Position Control

Fig 5.8 is 1-axis position control block diagram. For each axis, there are two 32 bit up-and-down counters for counting present positions and two comparison registers for comparing the present positions.

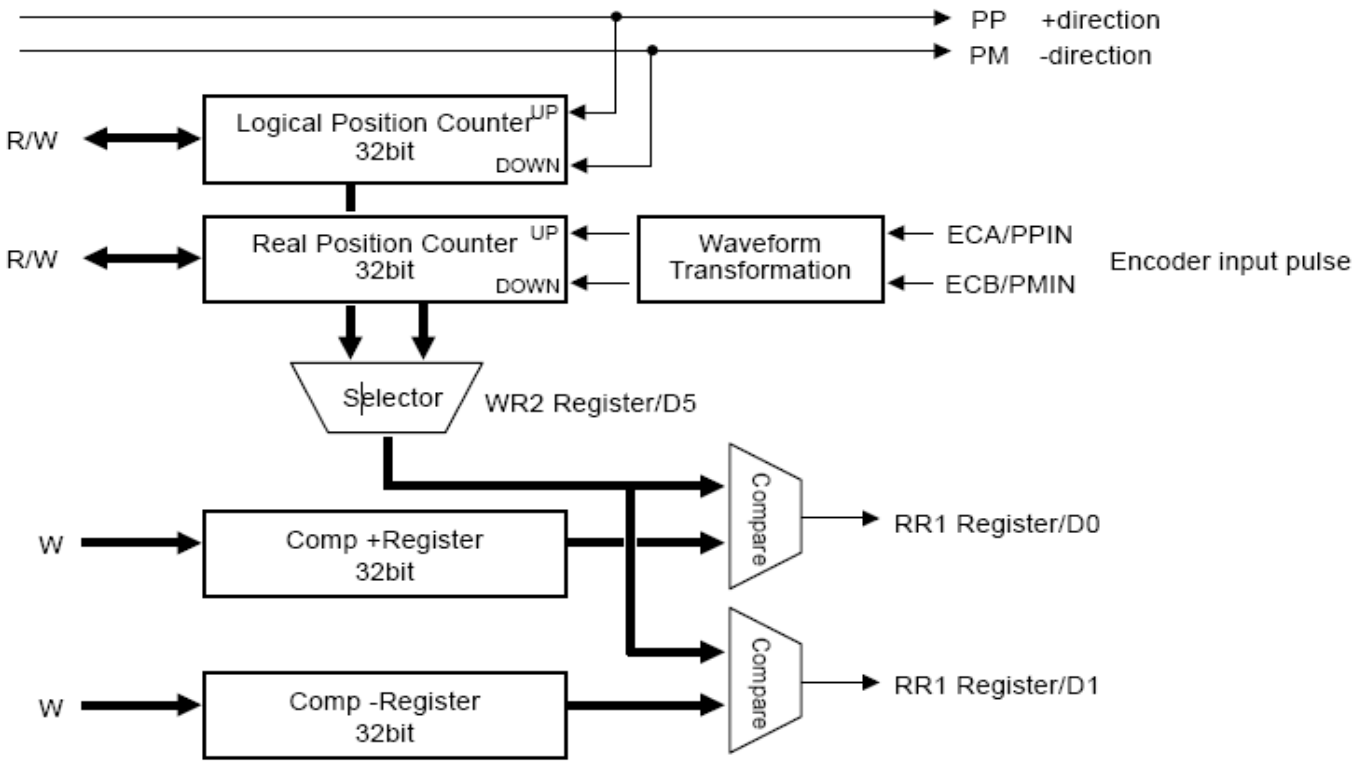


Fig. 5.8 Position Control Block Diagram

5.3.1 Logic Position Counter and Real position Counter

As shown above in Fig. 5.8, the logic position counter is counting the driving pulses in MCX312. When one + direction plus is outputting, the counter will count-up 1; when one - direction pulse is outputting, the counter will count-down 1. The real position counter will count input pulse numbers from external encoder. The type of input pulse can be either A/B quadrature pulse type or Up/Down pulse (CW/CCW) type.

Host CPU can read or write these two counters any time. The counters are signed 32 bits, and the counting range is between -2,147,483,648 ~ + 2,147,483,647. The negative is in 2's complement format. The counter value is random while resetting.

5.3.2 Compare Register and Software Limit

Each axis has, as shown in Fig. 5.8, two 32-bit registers which can compare the logical positions with the real positions. The logical position and real position counters are selected by bit D5 (CMPSL) of WR2 register. The main function of COMP+ Register is to check out the upper limit of logical/real position counter. When the value in the logical/real position counters is larger than that of COMP+ Register, bit D0 (CMP+) of register RR1 will become 1. On the other hand, COMP- Register is used for the lower limit of logical/real position counter. When the value of logical/real position counter becomes smaller than hat of COMP+ Register, bit D1 (CMP-) of register RR1 will become 1.

5.4 Interpolation

This 2-axis motion control card can perform linear interpolation, circular interpolation and bit pattern interpolation. In the process of interpolation driving, all the calculations will follow the X axis. So, the user has to set the parameters such as initial speed and drive speed of the X axis before performing the interpolation.

After setting all of the parameters for interpolations, and writing the interpolation driving commands to command register WR0, the user can start the interpolation driving. During the interpolation driving, D8 (I-DRV) of main status register RR0 will become 1 during the interpolation, and it will become 0 when the interpolation is finished. Also, during the interpolation driving, the bit D1 (Y-DRV) and D0 (X-DRV) will become 1.

The maximum drive speed is 4MPPS for linear, circular or bit pattern interpolation. For continuous interpolation, the maximum drive speed is 2MPPS.

Over Limit Error of Interpolation

When the hardware limit or the software limit of each axis is active during the interpolation driving, the interpolation will stop. The stop is occurred by errors, RR0 (main status register) will confirm the error bit in D5 (Y-ERR) and D4 (X-EWW). RR0 will become 1 and RR2 (error register) of this axis will be read out.

[Note] In case of circular or bit patter interpolation, the “active” of hardware or software limit, in either + or - direction, will stop the interpolation driving.

In-position Signal for Servo Motor

During the interpolation driving, when the in-position signal (nINP0S) of each X and Y axis is active, and also when the interpolation is finished, the INP0S signal of the axis is stand-by at its active level, and D8 (I-DRV) of RR0 register returns to 0.

5.4.1 Linear Interpolation

To execute the linear interpolation, the user can, according to the present point coordinates, set the finish point coordinates and the interpolation segment(s) for 2 axes. Fig. 5.9 shows an example of axis interpolation where linear interpolation is performed from the current coordinates to the finish point coordinates. For individual axis control, the command pulse number is unsigned, and it is controlled by + direction command or − direction command. For interpolation control, the command pulse number is signed. The resolution of linear interpolation is within ±0.5 LSB, as shown in Fig. 5.10

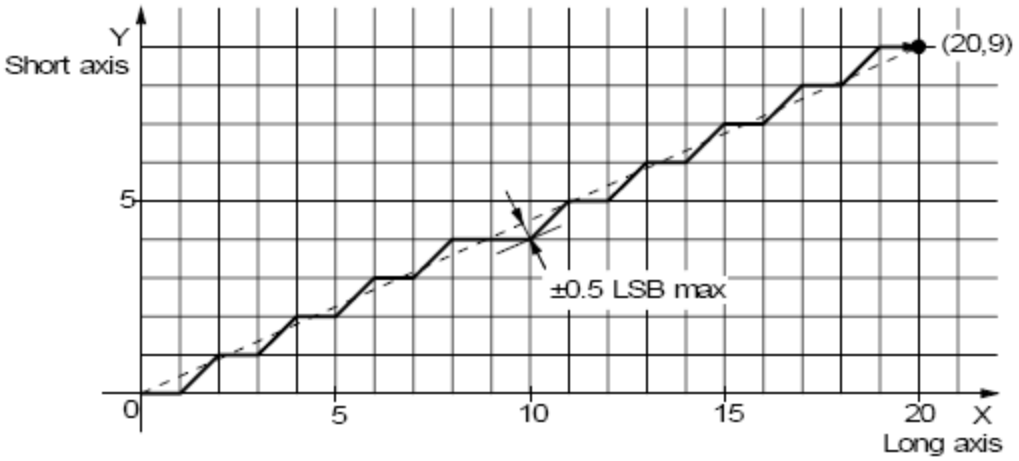


Fig. 5.9 The Position Accuracy for Linear Interpolation

As shown in Fig. 2.10, it is an example for pulse output of the linear interpolation driving. We define the longest distance

movement in interpolation is the “long axis”. And the other is “short axis”. The long axis outputs an average pulse train. The driving pulse of the short axis depends on the long axis and the relationship of the two axes.

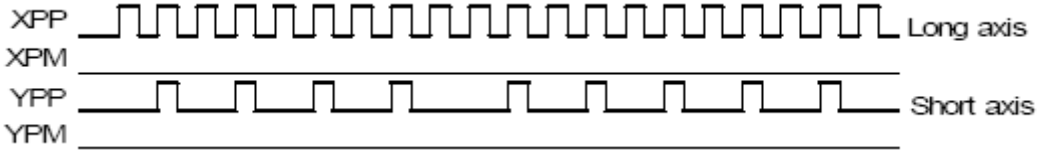
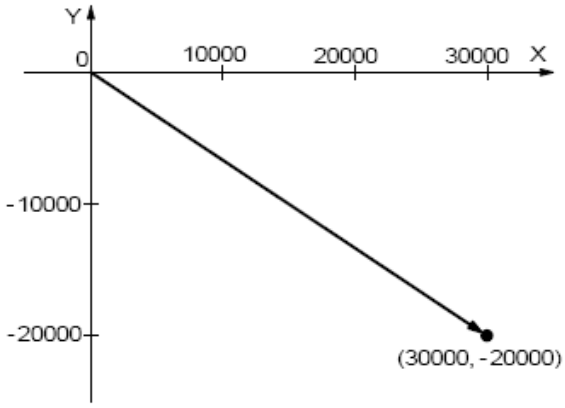


Fig. 5.10 The Example for Pulse Output at Finish Point (X=20, Y=9)

The example of linear interpolation for 2 axes

Executing linear interpolation drives in X and Y axes from the current position to the finish position (X: +30,000, Y: −20,000).

The initial speed = 500PPS, acceleration/deceleration = 40,000PPS/SEC, drive speed = 5,000PPS.



5.4.2 Circular Interpolation

2 axes X and Y are for circular interpolation. The circular interpolation is starting from the current position (start point). After setting the center point of circular, the finish position and the CW or CCW direction, the user can start the circular interpolation.

Note: The coordinates setting value is the relative value of the start point coordinates.

In Fig. 5.11, it explains the definition of CW and CCW circular interpolations. The CW circular interpolation is starting from the start point to the finish position with a clockwise direction; the CCW circular interpolation is with a counter-clockwise direction. When the finish point is set to (0, 0), a circle will come out.

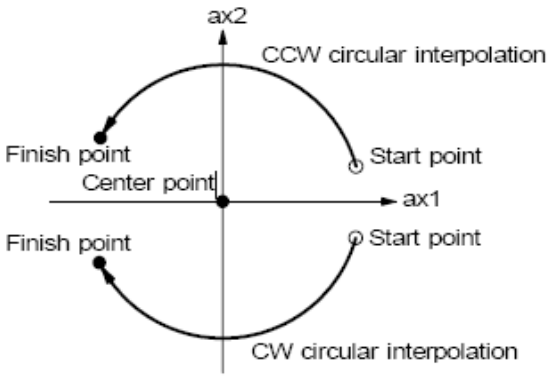


Fig. 5.11 CW/CCW Circular Interpolation

In Fig. 5.12, it explains the long axis and the short axis. First, we define 8 quadrants in the X-Y plane and put the numbers 0~7 to each quadrant. We find the absolute value of X is always larger than that of Y in quadrants 0, 3, 4 and 7, so we call X is the long axis (Y is the short axis) in these quadrants; in quadrants 1, 2, 5 and 6, Y is the long axis (X is the short axis). The short axis will output pulses regularly, and the long axis will output pulses depending on the interpolation calculation.

In Fig. 5.13, it is an example to generate a circle with the center point (-11, 0) and the finish point (0, 0).

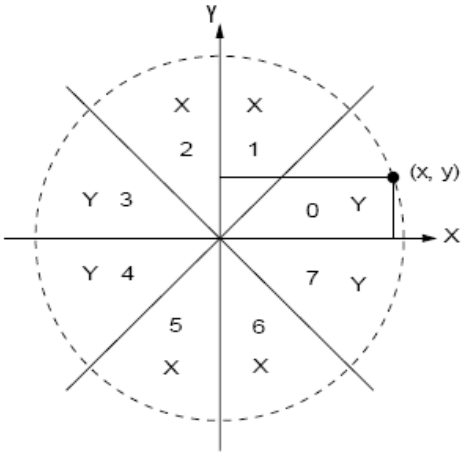


Fig. 5.12 The 0~7Quadrants And Short

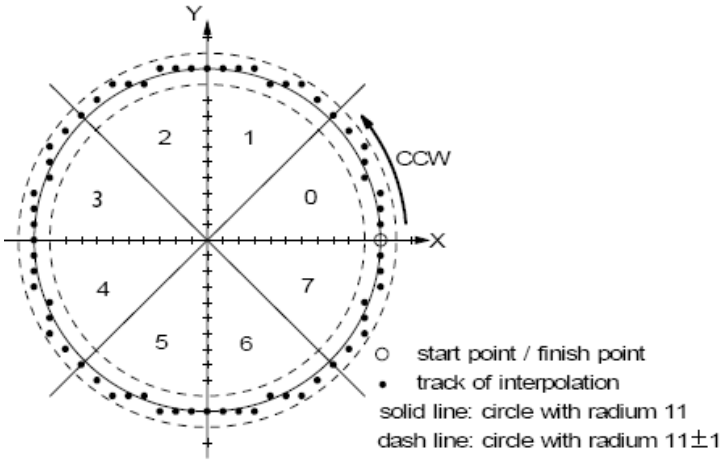
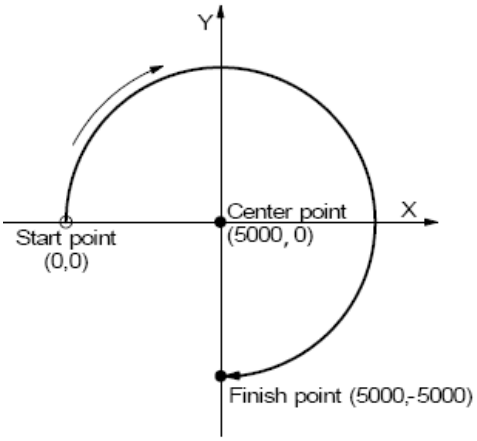


Fig. 5.13 The Example of Circular Interpolation

The Example for CW Circular Interpolation

This CW circular interpolation starts from the current point (start point: 0, 0) to the finish point (X: 5000, Y: −5000); the center point is X: 5000, Y: 0. The interpolating speed is constant at 1000PPS in a constant vector speed driving.



5.4.3 The Bit Pattern Interpolation

This interpolation driving receives interpolation data that is created by upper-level CPU and transformed to bit patterns in a block of a predetermined size, and outputs interpolation pulses consecutively at the specified drive speed.

Every axis has 2 bit-data buffers for host CPU: one for + direction and the other for - direction. When performing the bit pattern interpolation, the host CPU will write the designated interpolation data, for each axis X and Y, into USB1010. If a bit in the bit pattern data from CPU is “1”, USB1010 will output a pulse at the time unit; if it is “0”, USB1010 will not output any pulse at the time unit.

For example, if the user wants to generate the X-Y profile (see Fig. 5.14), the host CPU must write a set of pattern into those

specific registers ---- XPP: the + direction register for X axis, XPM: the − direction register for X axis, YPP and YPM: the + and − directions registers. With in the time unit, USB1010 will check the registers once and decide to output a pulse or not depending on the bit pattern.

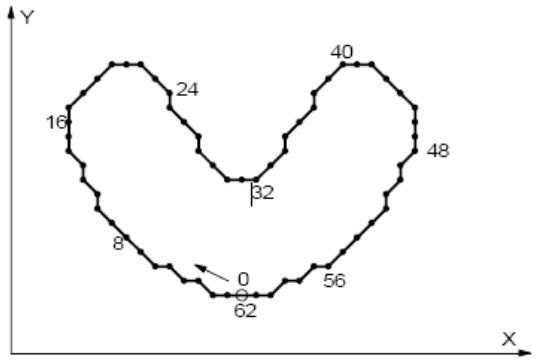


Fig. 5.14 Example for Bit Pattern Interpolation

5.4.4 Constant Vector Speed

USB1010 is with the constant vector speed control function which can control the resultant speed of two axes to keep the speed in constant.

Fig. 5.15 shows the profile of 2 axes interpolation driving. The vector speed reflects 1.414 times of the individual axis drive speed. So, we have to set the speed of 1.414 times to keep the vector speed for 2-axis driving.

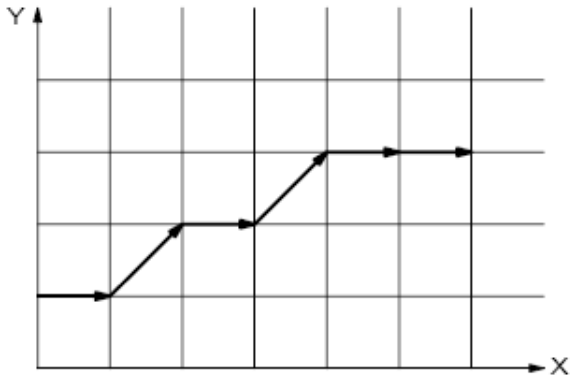


Fig. 5.15 Example of 2-Axis Interpolation

5.4.5 Continuous Interpolation

The continuous interpolation is executing a series of interpolation processes such as linear interpolation → circular interpolation → linear interpolation → ···.

During the continuous interpolation, the driving will not stop; contrarily, the pulses are output continuously. When executing the continuous interpolation, the host CPU has to write the next interpolation segment into MCX312 before the previous interpolation segment is finished.

Attentions for Continuous Interpolation

a. Before setting the interpolation segment, the user should first set other data such as center point, finish point… for each segment.
b. The maximum speed for the continuous interpolation is 2MHz.
c. The following interpolation segment must be loaded before the previous interpolation segment is finished.
d. The segment driving time should be longer than the time for error checking and the command setting of next segment during the interpolation.
e. In continuous interpolation, if one of 2/3 axes is 0, interpolation is performed correctly, otherwise, 0 cannot be set to the finish point of all axes in 2/3 axes linear interpolation, or to the center point of both axes in circular interpolation, any axis cannot set the data that drive pulse is not output. If suchlike data it set, interpolation cannot be performed correctly.

5.4.6 Hardware Limit Signals

Hardware limit signals, nLMTP and nLMTM, are used for stopping the pulse output if the limit sensors of + and − directions are triggered.

5.4.7 Emergency Stop

Signal EMGN is able to perform the emergency stop function for both X and Y axes during the driving. Normally, this signal is kept on the Hi level. When it is falling to the Low level, all axes will stop immediately, and the D5 (EMG) bit of register RR2 (each axis) becomes 1. Please be noted that there is no way to select the logical level of EMGN signal.

Chapter 6 Notes, Warranty Policy

6.1 Notes

In our products' packing, user can find a user manual, a USB1010 module and a quality guarantee card. Users must keep quality guarantee card carefully, if the products have some problems and need repairing, please send products together with quality guarantee card to ART, we will provide good after-sale service and solve the problem as quickly as we can.

When using USB1010, in order to prevent the IC (chip) from electrostatic harm, please do not touch IC (chip) in the front panel of USB1010 module.

6.2 Warranty Policy

Thank you for choosing ART. To understand your rights and enjoy all the after-sales services we offer, please read the following carefully.

1. Before using ART's products please read the user manual and follow the instructions exactly. When sending in damaged products for repair, please attach an RMA application form which can be downloaded from: www.art-control.com.
2. All ART products come with a limited two-year warranty:
   - The warranty period starts on the day the product is shipped from ART's factory
   - For products containing storage devices (hard drives, flash cards, etc.), please back up your data before sending them for repair. ART is not responsible for any loss of data.
   - Please ensure the use of properly licensed software with our systems. ART does not condone the use of pirated software and will not service systems using such software. ART will not be held legally responsible for products shipped with unlicensed software installed by the user.
3. Our repair service is not covered by ART's guarantee in the following situations:
   - Damage caused by not following instructions in the User's Manual.
   - Damage caused by carelessness on the user's part during product transportation.
   - Damage caused by unsuitable storage environments (i.e. high temperatures, high humidity, or volatile chemicals).
   - Damage from improper repair by unauthorized ART technicians.
   - Products with altered and/or damaged serial numbers are not entitled to our service.
4. Customers are responsible for shipping costs to transport damaged products to our company or sales office.
5. To ensure the speed and quality of product repair, please download an RMA application form from our company website.